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Maine Agricultural Experiment Station

BULLETIN No. 75. JULY, 1901.

ANALYSES OF MISCELLANEOUS FOOD MATERIALS.

This bulletin contains the results of analyses, together with discussion, of the Eggs of Domesticated Fowl, Egg Substitutes, Dried Eggs, Prepared Self-Raising Flours, Pea Flour, Gluten Foods, Condensed Foods or Emergency Rations, Acorns, Chestnuts, Malted Nuts, and Three Tropical Fruits, Alligator Pear, Jamaica Sorrel, and Surinam Cherry.

Requests for the Bulletins should be addressed to the

AGRICULTURAL EXPERIMENT STATION,

Orono, Maine.

MAINE

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ORONO, MAINE.

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ANALYSES OF MISCELLANEOUS FOOD MATERIALS.

CHAS. D. WOODS and L. H. MERRILL.

During the past three years the Station has had occasion to make chemical analyses of quite a number of different kinds and classes of materials used as food for man. The specimens were received from various sources, and while the results of the analyses have been used for the specific purposes for which they were made, they are for the most part still unpublished. Because it is believed that the results are of quite general interest, they are here brought together and discussed.

EGGS OF DOMESTICATED FOWLS.

The compilers of Bulletin 28 of the Office of Experiment Stations of the U. S. Department of Agriculture (the Chemical Composition of American Food Materials) found that, while there had been many (90) analyses of hens' eggs, no other American eggs had been analyzed. Accordingly, at the suggestion of the Director of the Office of Experiment Stations, the following analyses of turkey, goose, duck, and guinea fowl eggs were made.

The turkey eggs (6387) were furnished by the Rhode Island Experiment Station and were thus described by the Director:

"The birds which yielded the eggs sent you for analysis by request of the Office of Experiment Stations were just 'turkey.' I presume they were descendents of bronze turkeys, but they were certainly not pure bred fowls. The eggs were laid rather late (October) which enabled us to send them at that time. They had free range and were apparently healthy, vigorous birds."

The goose eggs (6388) were from the Sunnyfield Poultry Yards, South Portsmouth, R. I.

The duck eggs (6390) were "from pure blood Pekin ducks," and the guinea fowl eggs (6391) "from the ordinary speckled breed." Both samples were furnished by the Maryland Experiment Station.

WEIGHTS OF EGGS, AND WEIGHTS AND PERCENTAGES OF SHELL (REFUSE), WHITE, AND YOLK AS PREPARED FOR ANALYSIS.

Kind of egg.	Station number.	Individual egg.	Weight as received.	Weight Boiled.				Shell (refuse).	White.	Yolk.
				Shell (refuse).	White.	Yolk.	Total.*			
			Grams	Grams	Grams	Grams	Grams	%	%	%
Turkey	6387	a .	109.6	12.2	62.2	32.4	106.8	11.4	58.3	30.3
		b ...	104.2	11.6	59.4	30.4	101.4	11.4	58.6	30.0
		c	102.0	11.8	57.4	30.0	99.2	11.9	57.9	30.2
		d	106.4	11.4	61.4	30.6	103.4	11.0	59.4	29.6
		Avg.	105.5	11.7	60.1	30.9	102.7	11.4	56.5	30.1
Goose.....	6388	a....	195.6	23.6	101.8	66.6	192.0	12.3	53.0	34.7
		b...	190.4	24.6	98.0	64.0	186.6	13.2	52.5	34.3
		c	171.0	24.4	89.6	55.4	169.4	14.4	52.9	32.7
		d....	191.0	23.8	98.4	66.4	188.6	12.6	52.2	35.2
		e	194.0	24.4	100.4	67.2	192.0	12.7	52.3	35.0
		f	200.4	24.0	102.8	69.2	196.0	12.2	52.5	35.3
		Avg.	190.4	24.1	98.5	64.8	187.4	12.8	52.6	34.6
Duck.....	6390	a....	66.2	6.6	34.0	22.6	63.2	10.4	53.8	35.8
		b....	67.6	7.0	35.2	23.2	65.4	10.7	53.8	35.5
		c	72.6	7.6	37.0	25.0	69.6	10.9	53.2	35.9
		d ...	76.0	7.6	40.0	26.6	74.2	10.2	53.9	35.9
		Avg.	70.6	7.2	36.5	24.4	68.1	10.6	53.6	35.8
Guinea fowl	6391	a....	40.4	5.8	20.4	13.2	39.4	14.7	51.8	33.5
		b....	41.8	6.2	22.4	11.4	40.0	15.5	56.0	28.5
		c	38.8	5.2	19.6	12.8	37.6	13.8	52.2	34.0
		d....	39.6	5.2	21.0	12.6	38.8	13.4	54.1	32.5
		Avg.	40.2	5.6	20.9	12.5	39.0	14.4	53.6	32.0
Hens' †.....	....	.....	.....	.....	.....	.....	.....	11.2	.....	.....

*The decrease in weight includes loss in preparation of sample, as well as diminished weight due to cooking.

† Average of 34 samples, page 53, Bulletin 28 of the Office of Experiment Stations.

WEIGHT OF NUTRIENTS AND FUEL VALUE OF 1 POUND OF EGGS.

Station number.	Kind of Eggs.	Refuse (shells).	Water.	Protein.		Fat.	Ash.	Fuel value per pound.
				Nitrogen × 6.25.	By difference.			
	White of eggs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Calo.
6387	Turkey eggs	.....	.867	.115	.125	Trace.	.008	325
6388	Goose eggs	.....	.863	.116	.129	Trace.	.008	330
6390	Duck eggs	.....	.870	.111	.122	Trace.	.008	315
6391	Guinea fowl eggs	.....	.866	.116	.126	Trace.	.008	325
	Hens' eggs *	.....	.862	.123	.130	.002	.006	.....
	Yolk of eggs.							
6387	Turkey eggs	.....	.483	.174	.176	.329	.012	1875
6388	Goose eggs	.....	.441	.173	.184	.362	.013	1975
6390	Duck eggs	.....	.458	.168	.168	.362	.012	1980
6391	Guinea fowl eggs	.....	.497	.167	.173	.318	.012	1800
	Hens' eggs *	.....	.495	.157	.161	.333	.011	.....
	Edible portion (white and yolk).							
6387	Turkey eggs	.....	.737	.134	.142	.112	.009	850
6388	Goose eggs	...	.695	.138	.151	.144	.010	985
6390	Duck eggs	.....	.705	.133	.140	.145	.010	985
6391	Guinea fowl eggs	...	.728	.135	.143	.120	.009	875
	Hens' eggs †	.....	.737	.134	.148	.105	.010	.....
	As purchased (including shell).							
6387	Turkey eggs	.138	.635	.116	.122	.097	.008	735
6388	Goose eggs	.142	.597	.115	.129	.123	.009	860
6390	Duck eggs	.137	.609	.115	.121	.125	.008	880
6391	Guinea fowl eggs	.169	.606	.112	.119	.099	.007	730
	Hens' eggs †	.112	.655	.119	.131	.093	.009	.....

* Average of 11 analyses, page 54, Bulletin 28, of the Office of Experiment Stations.
† Average of 60 analyses, page 54, Bulletin 28, of the Office of Experiment Stations.

PREPARATION OF EGGS FOR ANALYSIS.

The analyses were made in the usual way by the official methods. The samples were prepared for analysis as follows:

The eggs as received were weighed individually and then "hard-boiled." Upon cooling each egg was weighed. The shells, whites, and yolks of each egg were carefully separated and weighed. The shells were then rejected. The whites as well as yolks were chopped with a chopping knife and tray till the pieces were about the size of kernels of wheat. The samples were then weighed and partially dried at a temperature of 45° C. After partially drying the samples were weighed and ground in a mortar. No attempt was made to determine the lecithins which were largely included in the fats.

The detailed weights and the results of the analyses are given in the preceding tables.

There is a great similarity in the proportion of shell, white and yolk in the eggs of the different domesticated fowl. Roughly speaking, the shell makes up about one-ninth, the yolk one-third, and the white about five-ninths of the whole eggs. The white of the egg is nearly seven-eighths water. The solids of the white are practically all nitrogenous matters and are sometimes said to be pure albumen. The Connecticut State Experiment Station has made an extended investigation of the white of hens' eggs and finds that it consists of four different though quite closely allied albuminoids. The usual factor for protein (nitrogen multiplied by 6.25) is apparently too small, and the protein "by difference" is probably the more accurate. It will be noted that the white of the different kinds of eggs are practically alike in composition and fuel values.

While the yolks of different kinds of eggs differ rather more in composition than the whites they are still remarkably alike. The yolk is rather less than half water. The solids are more than three-fifths soluble in ether. This ether extract consists of the ordinary fats (palmitin, stearin, and olein) and a small amount of other materials. The yolk is very complex in composition and the classes of nutrients are only approximately separated in the usual food analysis. It will be noted the protein "by difference" and "by factor" are practically the same and that the fuel value varies with the fat content from 1,800 calo-

ries per pound in the guinea fowl eggs with 31.8 per cent of fat, to 1,975 and 1,980 calories per pound in the duck and goose eggs with 36.2 per cent fat.

Egg Substitutes and Dried Eggs.

Because of the high price at which eggs are sold at certain seasons of the year and because of the readiness with which eggs loose their freshness, many attempts to produce satisfactory egg substitutes have been made. Some of the so-called egg substitutes consist chiefly of starch. These here reported upon are of animal origin and correspond somewhat nearly to eggs in their composition with the exception that they contain much less water and more of solid matter.

Because of the small amount of water and the high protein content, evaporated eggs resemble the concentrated foods described on pages 100-107 beyond. That they are used in this way in large quantities is illustrated by the fact that in 1898 the manufacturers of LaMont's Crystallized Eggs shipped over 100,000 pounds, equivalent to 400,000 dozen eggs, to the South African miners.

Ovine, (6389) made by Munroe & Co., 100 Maiden Lane, New York City, "takes the place of fresh eggs in baking." The directions state that "one ounce of Ovine is equivalent to five eggs. Take the required amount of Ovine (one heaped-teaspoonful about equal to one egg) and sift well with the flour. The more even the mixture, the better it will work. Use an ample amount of baking powder or yeast. Work the dough well. Less butter is needed for shortening if Ovine is used in place of eggs."

From the analysis below it will be noted that Ovine resembles the white of egg much more nearly than it does the entire egg. It has practically no fat and consists chiefly of nitrogenous matter. The analysis does not in any way explain why the makers should claim that it takes the place of "shortening," i. e., fat, as it contains practically none.

LaMont's Crystallized Egg (6395 and U. S. Department of Agriculture, No. 20496) is manufactured by C. Fred LaMont, St. Louis, Mo. "Simply fresh eggs with the water expelled. Dissolves readily in cold or luke warm water or milk." "Not a substitute but guaranteed simply shell eggs desiccated." Egg

Flake (U. S. Department of Agriculture No. 20524) and Crystallized Egg each have a composition corresponding to dried eggs without the shell, and give every indication of being desiccated eggs as claimed.

WEIGHTS OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF EGG SUBSTITUTES AS FOUND IN THE MARKET.

Laboratory number.	Name.	Water.	Protein.		Fat.	Ash.	Fuel value per pound.
			Nitrogen × 6.25.	By difference.			
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Calo.
6389	Ovine	.114	.739	.792	.003	.091	2105
6395	Crystallized Egg (LaMont)	.075	.471	.554	.338	.033	2945
20496	Crystallized Egg (LaMont)*	.050	.486	.555	.356	.039	
	Crystallized Egg (LaMont)						
	Average	.062	.479	.555	.347	.036	
20524	Egg Flake*	.068	.452	.512	.385	.035	

*Analysis (unpublished) by the Chemical Division of the U. S. Department of Agriculture.

Prepared Flours.

After the publication of the analyses of cereal foods in Bulletin 55 of this Station, quite a number of inquiries were received relative to self-raising flours. While inquiry among the dealers gave evidence that these goods were not very greatly used in the State, it was thought best to obtain samples for analysis of the brands more commonly sold.

As acid phosphate is cheaper than tartaric acid and as alum is a low-priced adulterant of baking powder, the samples were examined for these materials. The description of samples and results of the analysis follow. Beyond the table a discussion of these materials is given.

6396. Aunt Jemima's Pancake Flour. R. T. Davis Mill Co., St. Joseph, Mo.

"Pure and healthful." "It is made of the three staffs of life." "Wheat, corn and rice."

6397. Uncle Jerry's New England Corn and Rice Pancake Flour. I. Pieser & Co., 130-132 Washington St., Chicago, Ill.

"In this preparation we use corn, potatoes, wheat and rice." "Formula 92¼% wheat, rice corn and potatoes, 2½% salt, 5¼% leavening."

6398. Uncle Jerry's New England Self-Raising Buckwheat Flour. I. Pieser & Co., 130-132 Washington St., Chicago, Ill.

"Compound: 70% buckwheat flour, 20% wheat flour, 10% corn flour, and sufficient seasoning and leavening."

6399. Reliable Self Raising Prepared Flour. Reliable Flour Company, Boston, Mass.

"This reliable flour is made from the choicest selected wheat." "An absolutely pure cream of tartar preparation."

6400. Hecker's Superlative Self-Raising Flour. Hecker-Jones-Jewell Milling Co., New York.

"Mixture of pure flour and wholesome phosphatic leavening materials." "These goods conform strictly to the pure food laws of Pennsylvania." "Mixture of wheat flour, phosphate, soda and salt."

6401. U-re-ka Self Raising Prepared Flour. Ureka flour Co., Portland, Maine.

"Mixed Flour. Made of wheat flour, pure grape cream of tartar, bi-carbonate of soda and salt."

6402. Purina Health Pancake Flour. Purina Mills, St. Louis, Mo.

"Made from Purina health flour (whole wheat), corn flour, salt and the leavening properties—phosphate and soda.

6403. Century Health Self-Raising Pancake Flour. Purina Mills, St. Louis, Mo.

"Made of health products only, consisting principally of gluten whole wheat flour."

6404. Cereal Pancake Flour. The Cream Cereal Company, Xenia, Ohio.

"Guaranteed a purely grain product." "Absolutely free from adulterations of any kind." "A pop corn product."

6405. Swan's Down Prepared Cake Flour. Ingleheart Bros., Evansville, Ind.

"Prepared strictly from the purest and best winter wheat." "This is not self-raising flour."

WEIGHT OF TOTAL AND AVAILABLE CARBON DIOXIDE, ALUM AND PHOSPHORIC ACID IN ONE POUND OF PREPARED FLOUR.

Laboratory number.	Name.	Total carbon dioxide.	Available carbon dioxide.	Alum.	Phosphoric acid.
		Lbs.	Lbs.	Lbs.	Lbs.
6396	Aunt Jemima's Pancake Flour	.0027	.0024	.....	.0079
6397	Uncle Jerry's Pancake Flour	.0055	.0045	.0034	.0033
6398	Uncle Jerry's Buckwheat Flour	.0056	.0037	.....	.0001
6399	Reliable S-R Prepared Flour	.0073	.0062	.0027	.0001
6400	Hecker's Superlative S-R Flour	.0065	.0056	.....	.0089
6401	Ureka S-R Prepared Flour	.0058	.0032	.....	.0010
6402	Purina Health Pancake Flour	.0072	.0052	.....	.0033
6403	Century Health S-R Pancake Flour	.0037	.0017	.0019	.0009
6404	Cereal Pancake Flour.	.0048	.0042	.0022	.0003

WEIGHTS OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF PREPARED FLOURS.

Laboratory number.	Name.	Water.	Protein (N × 6.25).	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
		Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
6396	Aunt Jemima's Pancake Flour	.089	.094	.006	.761	.050	1705
6397	Uncle Jerry's Pancake Flour	.090	.107	.007	.746	.050	1680
6398	Uncle Jerry's Buckwheat Flour	.091	.109	.012	.730	.058	1670
6399	Reliable S-R Prepared Flour	.090	.030	.008	.782	.030	1690
6400	Hecker's Superlative S-R Flour	.094	.091	.009	.758	.048	1650
6401	Ureka S-R Prepared Flour	.090	.089	.009	.787	.025	1710
6402	Purina Health Pancake Flour	.089	.100	.016	.738	.057	1670
6403	Century Health S-R Pancake Flour	.086	.099	.009	.750	.056	1680
6404	Cereal Pancake Flour	.080	.122	.028	.727	.046	1740
6405	Swan's Down Prepared Cake Flour	.098	.103	.008	.792	.002	1470

The chief variation of a self-raising flour from a typical flour of the same grade is found in its higher ash content. A pound of straight patent flour will have about .005 pounds of ash. The ash in 1 pound of the self-raising flours (6405 is not self-raising) varies from .025 to .058 pounds. This added ash consists of common salt, and leavening materials. Patent flour usually carries about .002 pounds of phosphoric acid to the pound. Larger amounts than this in a self-raising flour indicates that acid phosphate has been added in the leavening. The use of phosphoric acid in place of cream of tartar is perfectly proper and indeed on some accounts preferable. Alum should not be present in flour. In small amounts its presence may be accidental. When as much as .002 pound occurs in a pound it is fair to assume that it was added intentionally. Alum is harmful and should not be used in flours or baking powders.

The amount of leavening is measured by the carbon dioxide which is evolved when the flour is wet up with water and heated. As shown by the analyses the total leavening power may be considerably in excess of the available, the proportion of the latter decreasing with age. If chemical leavening agents are to be used, it is far better to mix them with the flour at the time of baking.

Good bread flour with sufficient cream of tartar and soda as leavening material costs about 3 cents a pound. The ready prepared flours here reported upon were sold at the rate of 5.3 to 16.1 cents per pound. Because of the high cost, the poor keeping quality and the temptation to adulteration, from the standpoint of economy and health, the general use of prepared self-raising flours is unwise.

Pea Flour.

A five pound package of pea flour sent by Dr. Charles Caldwell of Chicago to the Department of Agriculture was forwarded to the laboratories of this Station for analysis. Dr. Caldwell regards the flour as a very promising addition to our food products. He recommends that it be mixed with wheat flour and used for bread making, "since it not only improves the flavor of the bread, but its texture as well, the loaf remaining soft and moist much longer than when wheat flour alone is employed." He suggests that it be compressed into cakes and

used as an army ration. Its preparation is supposed to include steam cooking, roasting and reduction by the roller process. It is light sulphur-yellow in color and nearly as fine as ordinary wheat flour. Its composition is given in the following table, together with that of dried peas and wheat flour.

WEIGHT OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF PEA FLOUR, DRIED PEAS, AND WHEAT FLOUR.

	Water.	Protein (N × 6.25).	Fat.	Carbohydrates.	Ash.	Fuel value.
	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
Pea Flour, 6430	.078	.284	.019	.587	.032	1884
Dried peas *	.095	.246	.010	.620	.029	1665
Wheat Flour †	.126	.117	.014	.738	.005	1763

* Bulletin 28, Office Experiment Station, p. 67.
† Average of 21 analyses made at this Station.

The pea flour is very rich in protein, containing nearly two and one-half times as much as wheat flour. If the product were placed upon the market at a moderate price it seems quite probable that it would find a ready use.

Gluten Foods.

In Bulletin 55 of this Station the analyses were given of several so-called gluten preparations which carried "only a little more protein and a little less carbohydrates than ordinary flour."

As a result of the publication of these analyses, we have received many letters from people suffering with diabetes asking for information relative to gluten preparations high in protein and low in carbohydrates. The Pure Gluten Food Company of New York claim that their goods are high in gluten and low in starch. These claims are substantiated by the analyses of samples which follow:

Breakfast Cereal Pure Gluten, (6342). The Pure Gluten Food Company, New York. "The Strength of the Wheat.

Gluten Breakfast Cereal is entirely free from starch and has received the highest medical endorsement for the treatment of diabetes, dyspepsia, obesity and Bright's disease. Gluten Breakfast Cereal is rich in nitrates and phosphates, the essentials in upbuilding and strengthening the tissues, muscles, nerves and bone. It contains none of the heating properties found in the cereals. It promotes perfect digestion."

Plain Gluten Flour, Pure Gluten, (6343). The Pure Gluten Food Company, N. Y.

"The ideal flour for diabetes, dyspepsia, obesity and Bright's disease. For making bread and crackers. Pure gluten flour is entirely free from starch and contains all the properties for muscle and fiber building. Our gluten preparations have received the highest medical endorsement. We invite comparison and chemical analysis."

Self-Raising Flour, Pure Gluten, (6344). The Pure Gluten Food Company.

"Pure Gluten Self-Raising Flour is the ideal preparation for making self-raising pancakes, muffins and gems. It contains all the nitrates or muscle and fibre producing qualities, and being entirely free from starch, it has none of the heating properties of other pancake flours, and will not therefore disturb digestion, nor produce derangements incident to warm weather. As a pancake or gem flour for diabetics and dyspeptics, it is incomparable in nutritive worth."

WEIGHT OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF THE PURE GLUTEN FOOD COMPANY'S GLUTEN PREPARATIONS.

Station number.		Water.	Protein.	Fat.	Crude fiber.	N-free extract.	Ash.	Fuel value per pound.
		Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
6342	Breakfast Cereal	.093	.437	.016	.003	.444	.007	2060
6343	Plain Gluten Flour	.099	.536	.012	.002	.345	.006	2150
6344	Self-Raising Flour	.098	.315	.014	.003	.532	.038	1885

Condensed Foods.

Within a few years there has been placed upon the market a considerable number of condensed or concentrated foods, designed for the use of armies, or for explorers, sportsmen and others, to be used under conditions that render it desirable to reduce weight and space to the minimum. The constantly increasing number of these articles indicates a correspondingly increased demand. How far the want has been met can, to a certain extent, be determined by a study of the analyses recently made at this Station and here reported.

CONDENSED FOODS. DESCRIPTION OF SAMPLES.

Laboratory number.	Brands and Manufacturers.
6323	Ration Cartridge, Pea, Beef, etc., Bovril, Limited, London.
6324	Campaigning Foods, Blue Ration, Bovril, Limited, London.
	a Meat Albuminoids. b Chocolate Basis.
6325	Campaigning Foods, Red Ration, Bovril, Limited, London.
	a Meat Albuminoids. b Chocolate Basis.
6326	Ration Cartridge, Potatoes, Beef, etc., Bovril, Limited, London.
6327	Emergency Ration, Bovril, Limited, London.
	a Meat Extractive Basis. b Chocolate Basis.
6328	Emergency Ration, Bovril, Limited, London.
	a Concentrated Beef. b Cocoa Paste.
6321	Nao Complete Meat Food, The Military Equipment Stores and Tortoise Tents Co., London.
6322	Army Rations, Mutton and Vegetables, Maconochie Bros., London.
6332	Standard Emergency Ration, American Compressed Food Co., Passaic, N. J.
6333	Standard Emergency Ration, American Compressed Food Co., Passaic, N. J.
	a Tablet. b Chocolate.
6335	Arctic Food, Arctic Food Company, Minneapolis, Minn.
6334	Tanty Emergency Ration, Tanty Cuisine, New York City.
6341	F. A. F. Co's Beef-Vegetable Stew, Franco-American Food Co., Jersey City Heights.
6407	Toril Beef Tea, Toril Albumen & Extract of Meat Co., Altoona-Hamburg.
6306	Soson, Toril Albumen & Extract of Meat Co., Altoona-Hamburg, Germany.
6329	Tropon, Troponwerke, Mulheim-Rhein.
6429	Plasmon, American Syndicate, New York City.
6330	Pain-de-guerre.

A large proportion of the foods examined were of English manufacture and may be classed under the general head of "emergency rations"—i. e., rations that, without fully satisfying the needs of the body, may still enable the consumer to continue his active pursuits for a few days without an appreciable loss of strength. Of the other articles examined, 3 consist chiefly of proteids and are designed not as foods in the general sense, but rather as articles of dietetic therapy. The results of the analyses follow:

WEIGHTS OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF CONDENSED FOODS.

Laboratory number.	Brand.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
		Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
6323	Ration Cartridge	.142	.219	.174	.407	.058	2016
6324	Blue Ration a.	.450	.222	.054	.224	.050	1160
6324	Blue Ration b.	.013	.072	.296	.601	.018	2536
6325	Red Ration a	.277	.215	.151	.310	.047	1843
6325	Red Ration b	.016	.064	.299	.605	.016	2497
6326	Ration Cartridge	.416	.220	.045	.270	.049	1237
6327	Emergency Ration a.	.122	.468	.246	.099	.065	2333
6327	Emergency Ration b.	.017	.072	.290	.602	.019	2497
6328	Emergency Ration a.	.037	.594	.269	.055	.045	2909
6328	Emergency Ration b.	.045	.065	.121	.747	.022	2099
6321	Nao Meat Food	.529	.130	.206	.106	.029	1378
6322	Army Rations	.636	.153	.128	.072	.011	1058
6332	Standard Emergency Ration	.056	.310	.216	.384	.034	2385
6333	Standard Emergency Ration a.	.063	.188	.203	.507	.039	2356
6333	Standard Emergency Ration b.	.010	.066	.214	.694	.016	2349
6335	Arctic Food.	.072	.178	.396	.283	.071	2606
6334	Tanty Emergency Ration	.660	.127	.102	.088	.023	910
6341	F. A. F. Co's Stew.	.662	.155	.119	.054	.010	978
6407	Toril Beef Tea	.156	.423	.003	.164	.254	1609
6406	Soson	.064	.931	.002	.....	.003	2444
6329	Tropon	.092	.885	.003	.012	.008	2317
6429	Plasmon	.085	.750	.002	.089	.074	2044
6330	Pain-de-guerre	.106	.108	.005	.768	.013	1719

The samples of concentrated foods were all received through the Office of Experiment Stations of the U. S. Department of Agriculture. Capt. E. L. Munson, surgeon of the U. S. Army, was making investigations of concentrated foods on the market with the especial purpose of studying their adaptability for army purposes in the Tropics. As a result of his inquiry, he obtained the samples herewith reported which were forwarded here for analysis.

CONDENSED FOODS. WEIGHT OF PACKAGE AND CONTENTS.

Laboratory number.	Brand.	Weight of original package.	Weight of Contents.		
			Total.	a.	b.
		Grams	Grams	Grams	Grams
6323	Ration Cartridge, Pea, Beef, etc	320	241		
6324	Blue Ration, Campaigning Food	340	247	169	78
6325	Red Ration, Campaigning Food	274	199	122	77
6326	Ration Cartridge, Potatoes, Beef, etc	382	283		
6327	Emergency Ration	330	233	120	113
6328	Emergency Ration	319	248	121	127
6321	Nao Meat Food	583	437		
6322	Army Rations	823	661*		
6332	Standard Emergency Ration	540	418†		
6333	Standard Emergency Ration	402	319	270	49
6335	Arctic Food	444	422		
6334	Tanty Emergency Ration	585	475		
6341	F-A Food Company's Stew	1151	964		
6407	Toril Beef Tea	Broken package			
6406	Soson	Broken package			
6329	Tropon	245	224		
6429	Plasmon	490	453		
6330	Pain-de guerre	55	55		

* Excluding 26 grams bone.

† Not including a tablet of tea, 18 grams, and two small boxes of pepper and salt, 6 grams.

CONDENSED FOODS. GRAMS OF NUTRIENTS IN PACKAGE.

Laboratory number.	Brands.	Net weight contents.	Weight of Materials in Package.					Total fuel value.
			Water.	Protein.	Fats.	Carbohydrates.	Ash.	
		Gms.	Grams	Grams	Grams	Grams	Gms.	Calo.
6323	Ration Cartridge	241	34.2	52.9	42.0	98.0	13.9	1071
6324	Blue Ration a	169	76.1	37.5	9.0	37.9	8.5	432
6324	Blue Ration b	78	1.0	5.6	23.1	46.9	1.4	436
6325	Red Ration a	122	33.8	26.2	18.5	37.8	5.7	496
6325	Red Ration b	77	1.2	5.0	23.0	46.6	1.2	424
6326	Ration Cartridge	283	117.9	62.3	12.6	76.4	13.8	772
6327	Emergency Ration a	120	14.6	56.1	29.6	11.9	7.8	617
6327	Emergency Ration b	113	1.9	8.2	32.7	68.0	2.2	622
6328	Emergency Ration a	121	4.5	71.8	32.6	6.7	5.4	776
6328	Emergency Ration b	127	5.7	8.3	15.3	94.8	2.9	588
6321	Nao Meat Food	437	231.3	56.9	90.1	46.2	12.5	1328
6322	Army Rations	661	420.2	101.2	84.3	47.9	7.4	1542
6332	Standard Emergency Ration	418	23.6	129.6	90.5	160.3	14.0	2198
6333	Standard Emergency Ration a	270	17.0	50.6	54.8	137.0	10.6	1402
6333	Standard Emergency Ration b	49	.5	3.2	10.5	34.0	.8	254
6335	Arctic Food	423	30.7	75.1	167.3	119.8	30.1	2430
6334	Tanty Emergency Ration	475	313.5	60.2	48.6	41.9	10.8	1482
6341	F-A-F Company's Stew	964	638.0	149.2	114.5	52.5	9.8	2460
6329	Tropon	224	20.5	198.2	.7	2.7	1.9	1144
6429	Plasmon	453	38.7	339.8	.8	40.3	33.4	2041
6330	Pain-de-guerre	55	5.9	5.9	.3	42.2	.7	208

The six preparations bearing the mark of Bovril, Limited, 30 Farringdon St., London, are all put up in tin cans in the form of flattened cylinders with rounded ends. These vary in length from 4½ to 7 inches and are easily opened by means of the key attached. All contain dried meats, in most cases mixed with vegetables, the whole ground and compressed. Four of the tins are made with a compartment containing one or more cakes of chocolate wrapped in tin foil. The inscription upon one of these cans (6327) is here given in full:

"Emergency Ration. Field service. This ration is not to be opened except by order of an officer, or in extremity. It is to be carried in the haversack and produced at inspections, etc. The ration is calculated to maintain strength for 36 hours if eaten in small quantities at a time." (Upon one end of the can) "Basis Meat Extractives and Albuminoids. May be used dry with or without biscuits, or as a soup one-fourth part boiled for 15 minutes in one pint of water." (On the other end of the can) "Chocolate Basis. The contents may be used dry, or one-fourth boiled in one pint of water. Bovril, Limited, London."

The Bovril goods, the Standard Emergency Rations, and Arctic Food may for convenience be classed together. It may be said of them all that they appear to be good articles and when prepared according to directions would probably furnish appetizing dishes, subject, of course, to the limitations common to all canned goods. The emergency rations 6327 and 6328 are "calculated to maintain strength for 36 hours if eaten in small quantities at a time." No direct claim of the kind is made for the other Bovril goods, though the statement that the Red Ration Cartridge (6323 and 6325) is "recommended to be used on alternate days with the Blue Ration Cartridge" (6324 and 6326), seems to imply that each of these cartridges is sufficient for a day. The package containing the Standard Emergency Ration, 6332, is said to contain "enough palatable food and drink to sustain one man for one day under all conditions." The Standard Emergency, (6333), is said to be sufficient for two hearty meals. These claims may very properly be considered here.

Various estimates have been made as to man's daily needs. These estimates have been based either upon a study of the daily waste of the body, or upon direct nutrition experiments, in which the daily food has been gradually reduced until a maintenance ration has been struck. While these estimates must vary not only with the individual, but with the habits and other conditions of the subject, an average may be fixed upon which is sufficiently exact for our present purposes. Of the standards given, those of Moleschott in Germany and Atwater in this country are perhaps as frequently quoted as any.

Moleschott gives the following diet as sufficient for a man performing a moderate amount of work:

Protein	120 grams.
Fats	90 grams.
Carbohydrates	330 grams.

This gives a total weight of 540 grams, or about 1 1-5 pounds of dry matter per day. By the use of the proper factors, we find that such a diet has a fuel value of 2,680 calories. That is, these quantities of nutrients, in the metabolic processes which they undergo in the body, yield an amount of heat sufficient to raise 2,680 kilograms of water 1° C., or about 5 tons of water 1° F.

It is an interesting fact that what constitutes an adequate diet for the European does not satisfy the American workman. By a study of dietaries in this country Atwater has found that a man at moderate labor requires daily about 125 grams proteids, with enough fats and carbohydrates to bring the fuel value up to 3,500 calories, an advance of about 30 per cent over Moleschott's estimate. This required fuel value may be supplied by adding to the 125 grams proteids, 100 grams fats, and 502 grams carbohydrates. In the following table these European and American estimates are compared.

	European.		American.	
	Grams.	Calories.	Grams.	Calories.
Protein	120	492	125	512
Fats	90	837	100	930
Carbohydrates	330	1353	502	2058
Total	540	2682	727	3500

In the following tables these standards are compared with the contents of the packages concerning which the previously mentioned claims are made. Since 6327 and 6328 are said to be sufficient for 36 hours, two-thirds of the contents of the package are taken as the basis for calculation. The emergency ration 6333 is said to suffice for two meals; in the table the contents are therefore increased by one-half to correspond with one day of three meals.

DIETARY STANDARDS COMPARED WITH CONDENSED FOOD RATIONS

Laboratory number.		Protein.	Fats.	Carbohydrates.	Calories.
		Grams.	Grams.	Grams.	
	European Standard	120.0	90.0	330.0	2682
	American Standard	125.0	100.0	502.0	3500
6327	Emergency Ration	42.9	41.5	53.3	780
6328	Emergency Ration	53.4	31.9	67.7	793
6323	Red Ration	52.9	42.0	98.0	1009
6325	Red Ration	31.2	41.5	84.4	860
6324	Blue Ration	43.1	32.1	84.8	823
6326	Blue Ration	62.3	12.6	76.4	686
6332	Standard Emergency Ration	129.6	90.5	160.3	2030
6333	Standard Emergency Ration	80.7	98.0	256.5	2294

The comparisons made in the table show that for the most part the claims are extravagant. With the exception of the two last given, none of the packages supply more than one-half the protein required to replace the waste of one day, and not more than one-fourth or one-third of the potential energy called for by the standards. Indeed a little thought would have shown that no ration containing less than one and one-half pounds of dry matter can supply the waste of the active adult human body. If we refer once more to the standards given, we will see that even if a food could consist of absolutely pure protein, fats and carbohydrates, it must contain from 540 to 727 grams, or from one and one-fifth to one and three-fifths pounds. In practice such a food is impossible. In addition to the water and waste matters invariably present, there will always be a varying amount of mineral salts in our food, a certain proportion of which is just as essential to our existence as any one of the three nutrients already considered. While an amount of food under one and one-half pounds may constitute a valuable "emergency ration," the continued use of such a diet must inevitably result in a reduction in strength and body weight.

The Pain-de-guerre is an evaporated bread used as a concentrated ration in the French army. The process of manu-

facture is secret. The sample as received consisted of a single biscuit, about 2½ inches long and 1 inch thick, weighing less than two ounces (55 grams). It is said when it is moistened the Pain-de-guerre takes up a great deal of water and swells so that it has the appearance of soft bread rather than that of a cracker. Because of the smallness of the sample, this property was not tested. Its chemical analysis would seem to indicate that it is made entirely of wheat with which it agrees quite closely in composition.

Malted Nuts.

Malted Nuts. (6178). Manufactured by the Sanitas Nut Food Co., Ltd., Battle Creek, Mich.

"A perfect food, can be used to the exclusion of all other foods for infants or other persons, is suited to all ages and possesses all the essentials of a perfect nutrient. Malted nuts is not a chemical mixture of food elements, but a simple preparation of natural products, predigested and otherwise prepared for prompt and perfect assimilation."

As shown below, the claimed analysis on the wrapper corresponds closely with the results of the analysis of the sample here reported upon.

WEIGHT OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF MALTED NUTS AS CLAIMED BY THE MANUFACTURERS AND FOUND BY ANALYSIS.

Claimed Analyses.	Lbs.	Analyses here Reported.	Lbs.
Water	.045	Water	.026
Vegetable Albumin	.236	Protein	.237
Nut fat (perfectly emulsified)	.204	Fat	.276
Digested starch (Maltose, etc.)	.493	Carbohydrates	.439
Salts	.022	Ash	.022
		Fuel value, Calories per pound	2,600

Acorns (*Quercus*).

In Bulletin 54 of this Station, Nuts as Food, there were given the results of analyses of acorns from the common black oak of Arizona, *Quercus Emoryi*, and samples of acorn meal and acorn bread used by the Indians of the Yosemite Valley as food. We were indebted to Dr. Chestnut of the Division of Botany, U. S. Department of Agriculture for these samples. In April, 1900,

Dr. Chestnut sent us specimens of the "Valley White Acorn," *Quercus lobata*, "one of the acorns which is most abundantly used by the Indians of Mendecino county, California." This is analyzed as number 6312. In shelling the nuts it was found that about half of them were spoiled. The edible portion of good ones made up the sample taken for analysis, but the proportion of shell (refuse) to kernel (edible portion) is based upon all of the acorns, good and poor.

Weight of acorns, 130 grams.
Edible portion, kernels, 93 grams, 71.54 per cent.
Refuse, shells, 37 grams, 28.46 per cent.

The composition is given below together with that of the acorns previously analyzed: It will be noted that the acorns of *Quercus lobata* are much lower in fat content and higher in carbohydrates than the other samples examined. This affects the fuel value markedly, as the fats have much greater heats of combustion than the carbohydrates.

WEIGHT OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF ACORNS, ACORN MEAL, AND ACORN BREAD.

Laboratory number.		Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound.
6312	Acorn, Q. lobata,	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
	Edible portion	–	.075	.052	.086	.763	.024	1930
	As purchased.....	.285	.054	.037	.061	.546	.017	1380
6193	Acorn, Q. Emoryi,							
	Edible portion	–	.041	.081	.374	.480	.024	2720
	As purchased.....	.356	.026	.052	.241	.309	.016	1750
6184	Acorn meal	–	.087	.057	.186	.650	.020	2265
6185	Acorn bread.....	–	.603	.022	.099	.270	.006	2345

Italian Chestnuts.

These nuts were purchased in Boston and were used in digestion experiments. During the process of drying, a few of the nuts moulded, giving an unusually large proportion of bad nuts. Five kilograms gave:

Kernels, 3832 grams, 76.64 per cent.
Shells, 472 grams, 9.45 per cent.
Bad Nuts, 696 grams, 13.91 per cent.

The chemical composition is shown in the following table, to which is added for comparison two analyses of Italian varieties grown in California:

WEIGHT OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF ITALIAN CHESTNUTS.

	Shells.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value.
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
Edible portion,							
Maine Station, 6393.....	-	.449	.039	.021	.477	.014	1075
California grown *	-	.538	.066	.020	.369	.007	-
California grown *.....	-	.527	.041	.020	.404	.008	-
As purchased,							
Maine Station, 6393.....	.094	.407	.035	.019	.432	.013	974
California grown	.154	.455	.056	.017	.312	.006	-
California grown	.155	.445	.035	.017	.341	.007	-

*Calif. Experiment Station, Report 1896-7, p. 153.

Three Tropical Fruits.

The Division of Pomology of the U. S. Department of Agriculture has furnished the Station with specimens of three little used tropical fruits, the cultivation of which is being introduced into the subtropical portion of the United States by the Department of Agriculture. The description of the fruits and the uses to which they are put are furnished by Mr. William Taylor, Pomologist in charge of Field Investigation of the Department.

SURINAM CHERRY,

Sometimes called Pitanga. 6313. This is the ribbed, roundish, oblate fruit of *Eugenia Michelii*. It is a tropical shrub, native to Brazil and other tropical portions of South America, attaining a height of about 20 feet. It is sparingly grown in Southern Florida and Southern California, where the fruits are esteemed for their sharp but pleasant acid flavor. They are somewhat used in domestic jelly-making, but the product has not yet attained commercial recognition,—at least in this country.

The samples analyzed were grown at Rockland Grove, Lemon City, Florida.

Weight of cherries, 140 grams.	
Edible portion, 116 grams,	82.86 per cent.
Stems and stones, 24 grams,	17.14 per cent.

WEIGHTS OF NUTRIENTS OF ONE POUND OF SURINAM CHERRIES.

	Water.	Protein.	Carbohydrates.	Ash.
	Lb.	Lb.	Lb.	Lb.
In fresh pulp	.850	.004	*.139	.007
Edible in one pound whole fruit	.704	.003	.115	.006

* Including invert sugars, .100 pound; total sugars, .101 pound.

AVOCADO,

Also known as Aguacate, Alligator Pear and Mid-Shipman's Butter. 6282.

This interesting fruit,—*Persea gratissima* of botanists—is the product of a tree native in tropical America, but now widely grown throughout tropical countries. The principal commercial supply in the markets of the United States comes from Jamaica, though there is a considerable and increasing production in Southern Florida, both on the mainland and the keys, and a small production in the milder portions of Southern California.

The West Indian type of the species—which is the only one found in our Eastern markets—yields a fruit as large as our

largest pears. The varieties differ considerably in form, and range from deep purple to light green in color.

The principal use to which this fruit is put is that of salad making. The soft buttery substance of the fruit lends itself to this use admirably. The Mexican type which is now being tested in both Florida and California, yields a much smaller fruit, but the tree is reputed to endure several degrees of frost, whereas the tree of the West Indian type is injured by a temperature of 32 degrees. The Mexican type is also reported to be of more dwarfish habit than the West Indian, the latter becoming a tree of large proportions.

The specimens analyzed were grown at Cocoanutgrove, Florida. Three pears were received, representing three distinct varieties. The pulp of the pears was mixed and analyzed as one specimen.

Weight of three fruits, 1,021.6 grams.

Edible portion,	762.2 grams,	71.09 per cent.
Seeds,	201.4 grams,	19.71 per cent.
Skins,	94.0 grams	9.20 per cent.
	1,021.6	100.00

WEIGHTS OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF ALLIGATOR PEAR.

	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
	Lb.	Lb.	Lb.	Lb.	Lb.	Calo.
In one pound of edible portion.....	.811	.010	.102	.068	.009	1758
Edible in one pound of whole fruit....	.576	.007	.073	.049	.006	

ROSELLE,

Also known as Jamaica sorrel, 6394,—the *Hibiscus Sabdariffa* of botanists—is a widely distributed tropical plant yielding the Roselle fiber of commerce. As grown in Florida and California it is an herbaceous annual. It is valued in both states for its fleshy, acidulous calyces from which jellies and preserves are made that are of a beautiful wine-red color and have

a flavor approaching that of the cranberry. The plants are grown from seed planted in the spring and they require a long season free from frost to mature the crop. Under favorable conditions they produce a very heavy, continuous crop of blossoms in the latter part of the summer and autumn. The thick, juicy, dark red calyces are the only portions used, and these are at their best soon after the petals fall. If the harvest is long delayed, the enlarging ovary forms too large a proportion of the product and lessens its value by detracting from the acidulous flavor of the jelly or preserves.

The specimens examined were from Oneco, Manatee Co., Florida. The pod and calyx were analyzed separately. Extracts from both pod and calyx were also analyzed. 125 grams of the pods with the enclosing calyx gave:

Pods, 63.1 grams,	50.48 per cent.
Calyx, 61.9 grams,	49.52 per cent.

WEIGHTS OF NUTRIENTS AND FUEL VALUE OF ONE POUND OF JAMAICA SORREL.

	Water.	Protein.	Fat.	Carbohydrates.	Ash.
	Lb.	Lb.	Lb.	Lb.	Lb.
Calyx	.865	.021	.003	.103	.008
Pod	.840	.017	.010	.122	.011
Extract from calyx	.912	.009	.....	*.072	.007
Extract from pods.	.937	.015	.....	†.042	.007

* Including sugars, .016 lb. † Including sugars, .010 lb.

LIST OF BULLETINS PUBLISHED SINCE JANUARY, 1900.

59 Feeding Stuff Inspection.
60 Fertilizer Inspection.
61 Notes on Insects and Plants.
62 Historical Sketch of the Maine Station.
63 Feeding Stuff Inspection.
64 Poultry Experiments in 1899.
65 Coffee Substitutes, Nut Oils, Testing Seeds, Potato Pomace.
66 Fertilizer Inspection.
67 Digestion Experiments with Sheep.
68 Experiments with Insecticides upon Potatoes.
69 Finances, Meteorology, Index.
70 Oats as Grain and Fodder.
71 Feeding Stuff Inspection.
72 Fertilizer Inspection.
73 Experiments with Fungicides upon Potatoes.
74 Ashes, Mucks, Sea Weeds and Bone.

Copies of the above will be sent free on application to any address in Maine. A list of earlier Station publications which are still available for distribution can be had on application.